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GB 1589181
GB 1588442
GB 1569812
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GB 1473925
GB 1473924
GB 1449285
GB 1415324
GB 1217892
GB 1090336
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GB 967455
(58) Field of search A5T

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(54) Disposable respirator

(57) A foldable respirator fabricated from a continuous multilayered web of its composite materials and offering optimum edge-to-face seal with avoidance of inhalation collapse during use.

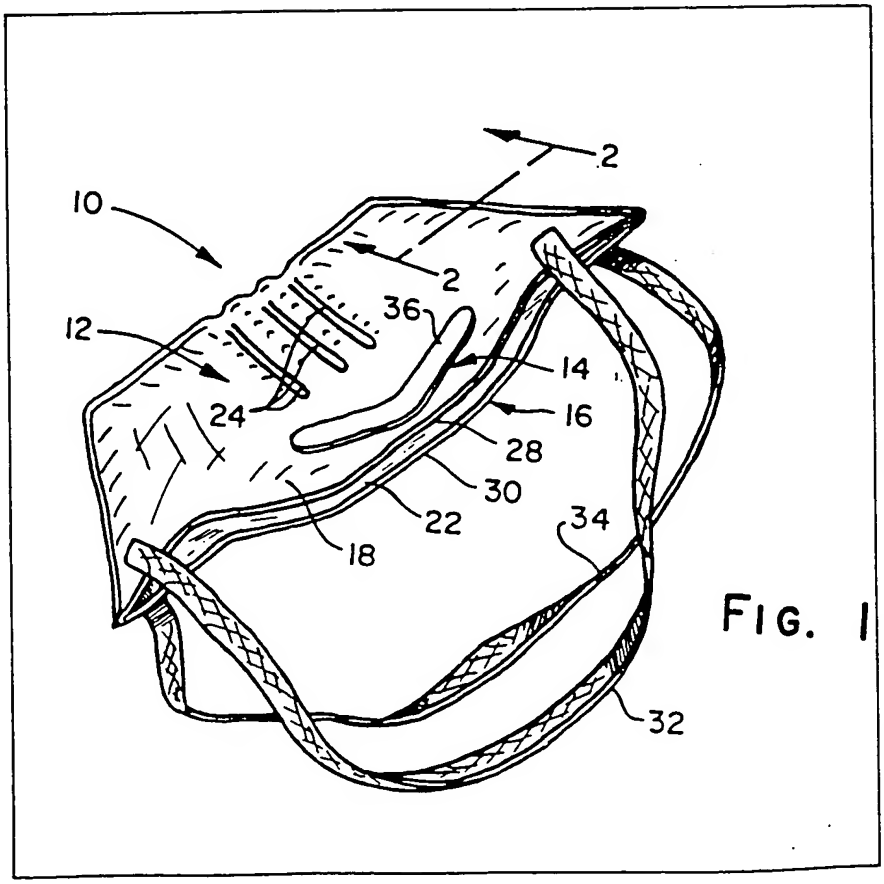

FIG. 1

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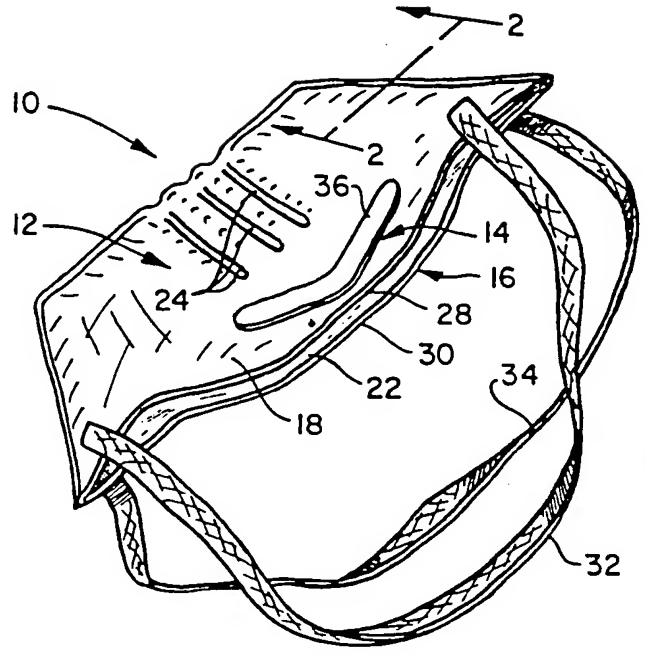


FIG. 1

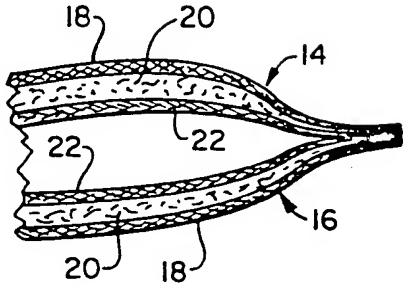


FIG. 2

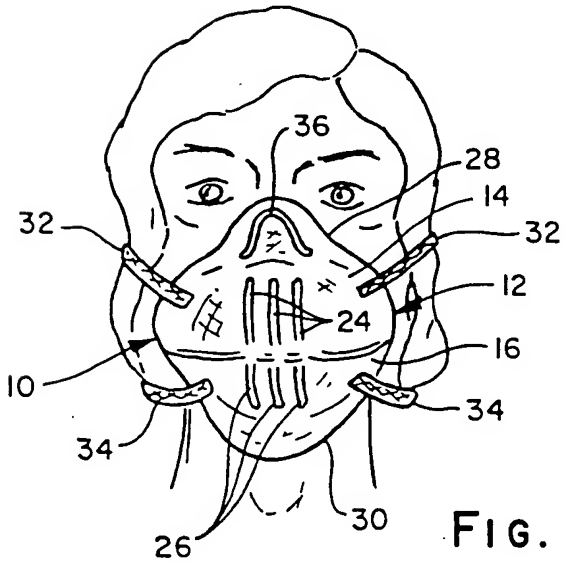
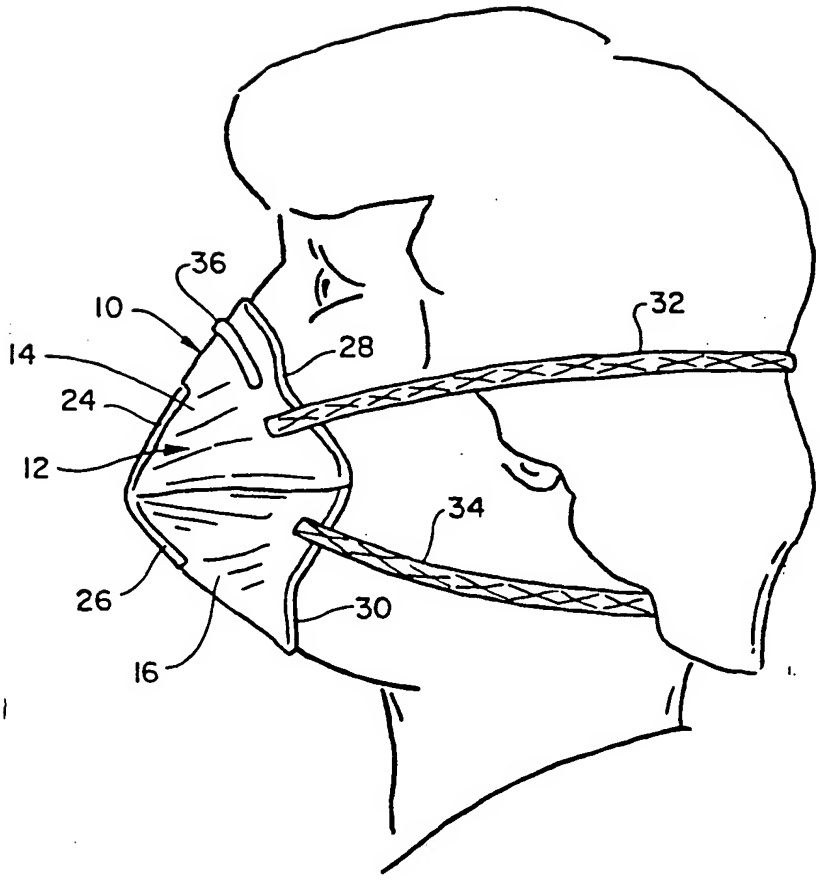


FIG. 3



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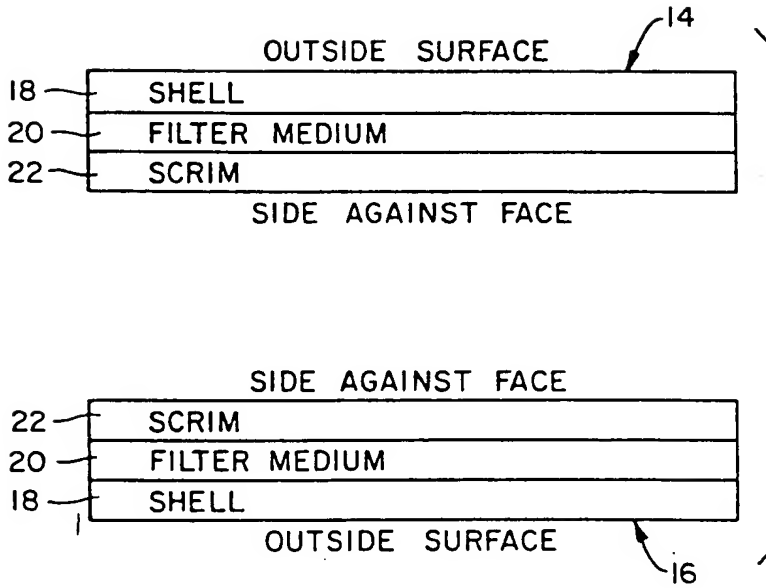
14
OUTSIDE SURFACE
18
SHELL
20
FILTER MEDIUM
22
SCRIM
SIDE AGAINST FACE
SIDE AGAINST FACE
22
SCRIM
20
FILTER MEDIUM
18
SHELL
OUTSIDE SURFACE
16

FIG. 5

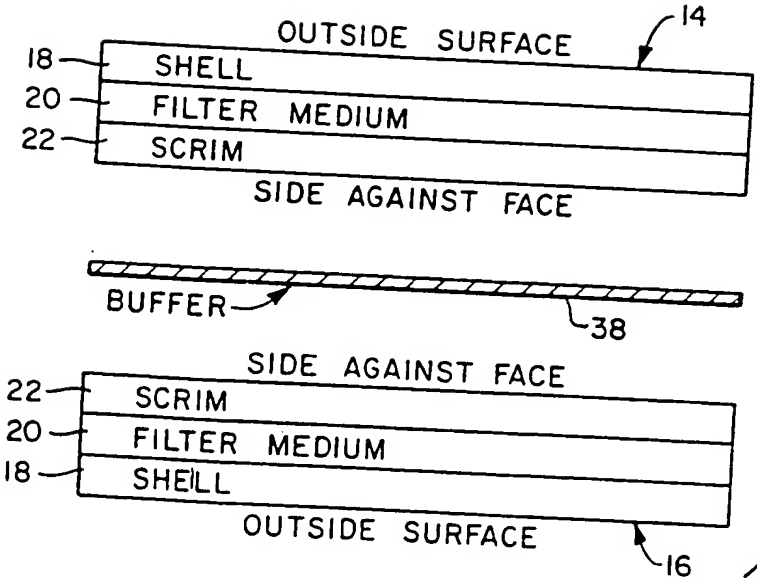
OUTSIDE SURFACE
14
18
SHELL
20
FILTER MEDIUM
22
SCRIM
SIDE AGAINST FACE
BUFFER
38
SIDE AGAINST FACE
22
SCRIM
20
FILTER MEDIUM
18
SHELL
OUTSIDE SURFACE
16

FIG. 6

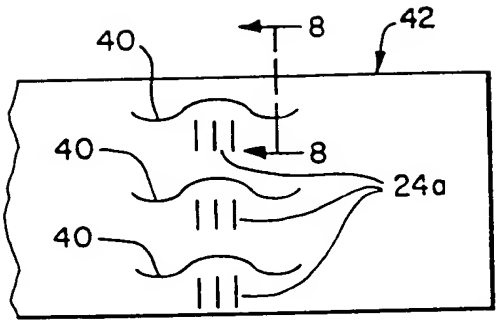

FIG. 7

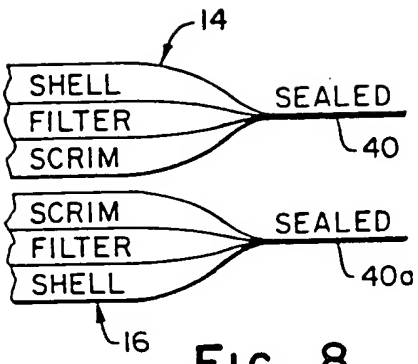

FIG. 8

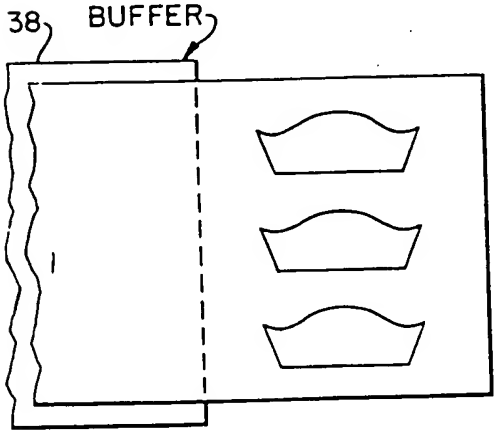

FIG. 9

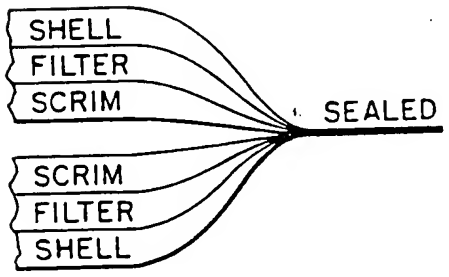

FIG. 10

SPECIFICATION

Disposable respirator

This invention relates to disposable respirators more particularly of the foldable type which offer protection against pneumoconiosis and fibrosis producing contaminants.

It is important to seek the protection of one's respiratory system with a respirator when subjected to unpleasant or noxious environments. However, respirator wearing comfort, convenience of carrying and freedom from maintenance are paramount to overcoming the commonly encountered resistance to use.

In addition to a further desire for compactness, lightness of weight and comfort of face fit, a wearer's ready acceptance of a particular respirator design requires minimal resistance to breathing through the face piece and avoidance of heretofore encountered "hot and clammy" breathing atmosphere within the face piece. This, in turn, requires adequate spacing of the face piece around nose and mouth and avoidance of collapse during inhalation.

Heretofore, the above has been best attended to with rigidly cupped and/or frame supported respirator structures of types exemplified by U.S. Patents Des. 248,497 and 3,521,630. These, however, suffer the disadvantages of costly manufacture, ungainliness in storage and carrying by workers as well as a vulnerability to damage by crushing, particularly in the case of the type of structure illustrated in U.S. Des. 248,497. Frame supported structures, on the other hand, require periodic cleaning of the support structure, tedious filter replacement and provision for clean storage of the devices between times of use.

In view of the above, the more easily carried foldable and disposable pocket respirator is attractive to workers and suppliers alike. However, such devices of which those of U.S. Design Patent No. 249,072 and U.S. Patent No. 4,248,220 are exemplary, lack the effectiveness of the cup-formed or frame-supported devices. In particular, they lack the ease of application to the face, comfort of final fit, resistance to collapse and air filtering capability of multiple layer filterning systems. Additionally, complicated pleating, stitching, riviting and other assembly procedures needed to produce prior art folded respirators render them relatively difficult and costly to produce.

One object of the present invention is to provide improvements in folded respirators and method of making same.

Another object is to provide for simple and economical mass production of the respirators, more particularly by use of a continuous multiply layered web of disposable materials.

Still another object is to provide an end product offering exceptional face-fitting and breathing comfort with optimum air filtering efficiency.

According to one aspect of the present invention we provide a folded respirator comprising:

a pair of superimposed multiply layered webs of air-permeable materials, at least one of which is characterized by an adaptability to filtering undesirable airborne contaminants with a passage of air therethrough;

said webs each having one edge of special curvilinear outline for face-fitting purposes when said resporator is brought to use;

the material of said webs being all edge joined together about all but said one curvilinear edge of each and similarly separately joined together along said curvilinear edges whereby selective separation of said separately joined curvilinear edges opens said respirator for wearing; and

means for holding said opened respirator against a wearer's face.

According to another aspect of the invention we provide a method of making a folded respirator comprising the steps of:

superimposing first and second webs of multilayered respirator facepiece material;

performing one of the following steps in an order preceding the other;

(a) separately joining layers of each web together along a line configured to provide a face-engaging edge of said respirator;

(b) joining all layers of said first and second webs together along at least one line extending away from an intended position of one of corresponding ends of said lines of face engaging edges of said respirator to the opposite of corresponding ends of said face-engaging edges;

trimming said webs around and outwardly of all of said lines of joining of said materials; and

attaching head supporting means to at least one of said trimmed webs.

Reference is now made to the accompanying drawings, in which:–

Figure 1 is an illustration, in perspective, of a preferred embodiment of the invention;

Figure 2 is an enlarged cross-section taken along line 2-2 of Figure 1;

Figure 3 is a front elevational view of the respirator of Figure 1 shown in a position of use;

Figure 4 is a side view of the respirator of figures 1 and 2 also shown in a position of use;

Figure 5 and 6 are diagrammatic illustrations of a cross-section of a materials assembly used in practice of the invention;

Figure 7 is a plan view of the Figures 5 and 6 assembly following a first heat sealing operation of the invention;

Figure 8 is a cross-sectional view taken along line 8-8 of Figure 7 wherewith results of the heat sealing operation are illustrated in diagrammatic fashion;

Figure 9 is another plan view of the Figures 5 and 6 assembly illustrating an additional heat sealing operation of the illustrated process; and

Figure 10 is a cross-sectional view taken along line 10-10 of Figure 9.

Referring to the drawings, respirator 10 (Figure 1) is shown flat, i.e. folded, for convenience of packaging, shipping and/or carrying in a worker's pocket as a spare or when not needed on the face. In Figures 2 and 3, respirator 10 is opened and illustrated in a position of use.

Body 12 of the respirator comprises superimposed top and bottom webs 14 and 16, of layered air-

filtering material. Each web preferably includes an outer shell 18, an intermediate lofty filter medium 20 and inner scrim 22. The layers are edge or rim sealed together leaving the intermediate material generally uncompressed and highly efficient in its intended air-filtering function. Ribs 24 and 26 formed by material heat sealing may be provided for body 12 shape retention and assurance reinforcement against collapse during inhalation.

Essential to the accomplishment of secure edge sealing of webs 14 and 16 is a selection of materials which have heat-sealing compatibility. The following are exemplary:

Outer shell structure 18 requires a material capable of withstanding direct handling abuses but having a porosity permitting easy passage of inhaled and exhaled air. A mesh of polyester fibres with a heat-sealable binder of polyvinyl chloride may be used, Suitable commercially available products are Stearns and Foster Type 4144X or W3499 polyester non-woven media supplied by The Stearns and Foster Company of Cincinnati, Ohio, USA and Union Wadding 7 oz. polyester non-woven media supplied by Union Wadding Company of Pawtucket, Rhode Island, USA.

Inner filter medium 20, preferably maintained in a somewhat lofty state between lines of heat sealing may comprise a random gathering of polyester fibres with a thermoplastic medium. Vinyon and/or viscose fibres may be used. A suitable commercially available product is Riegel Stype S-03059-1 polyester 100 gram/sq. meter supplied by Riegel Products Corporation of Milford, New Jersey, USA.

Scrim 18 which engages the face when worn may comprise a soft highly porous web or mesh of polypropylene. A suitable commercially available product is Snowpro Style # 440-0827 polypropylene filter media .8 oz/sq.yd. supplied by Snow Filtration Company of Cincinnati, Ohio, USA.

It should be understood that in the combination of materials selected for webs 14 and 16, those happening to be less responsive than others to sealing together may, nevertheless, be readily joined to the others having greater response to dielectric or other forms of heating.

While edge and other heat sealing operations of the present invention are preferably performed dielectrically with conventional apparatus well known to the artisan and not requiring discussion herein, it should be understood that electrically or otherwise heated dies and the like, with applied pressure and/or ultrasonics may also be used. Furthermore, edge and/or rib sealing of the present respirator structure may employ adhesives if necessary or desired. Stitching, which is presently considered least desirable, may nevertheless be employed throughout or in partial assembly of the respirator.

It should be understood that while the above mentioned materials and sources of supply will provide for successful practice of the invention, this information is not to be taken as limitive or in any sense restrictive to the invention. Those skilled in the art will readily appreciate that various other commercially available or specially prepared synthetic and/or natural fibre mediums, webs, meshes, shells or scrims may be obtained or produced and used.

Referring more particularly to the respirator 10 shape, it can be seen from Figures 1, 2 and 3 that special curvilinear edge contours 28 and 30 have been selected to provide a comfortable substantially airtight seal about the nose, mouth and chin when respirator 10 is positioned for wearing and held by elastic headbands 32, 34. Remaining edges may be rectilinear and angularly related as illustrated, right angularly related or comprise only two acutely angled sides or a single semicircular side connecting opposite ends of edges 28 and 30.

An attached malleable chevron 36 facilitates fitting and maintaining fit of the respirator over the nose. The chevron may be formed of a strip of aluminium or its equivalent and cemented in place.

By pressing the chevron toward the nose after application of the respirator the aforesaid nasal sealing may be readily accomplished. While the nose area is usually considered the most difficult to fit and seal it can be readily attended to in this manner.

As illustrated in Figures 1, 2 and 3, respirator 10 may be quickly and efficiently converted from its folded, pocket carrying configuration (Figure 1) to a relatively rigid cupped configuration for wearing by opening edges 28 and 30, placing the opening over the nose, mouth and chin, slipping headbands 32, 34 over the head and shaping chevron 36 against the nose.

Ribs 24 and 26 lend rigidity to the opened structure, assist in the prevention of collapse of respirator body 12 during inhalation and retain ample space between nose, mouth and respirator inner walls to avoid undue overheating and/or "clamminess" of the internal breathing atmosphere.

A preferred manner of constructing respirator 10 is illustrated diagrammatically in Figures 5 - 10. Therein a mass production technique, using a continuous supply (strip 42) of materials, is demonstrated. It should be clear, however, that this technique can be geared to large or small production or, in fact, a one respirator at a time operation.

In Figure 5, a schematic or layered materials illustrates, in cross-section, the initial orientation of materials used to produce webs 14 and 16 of resporators according to the invention.

In the illustrated orientation of materials, 18, 20 and 22 used to produce each of webs 14 and 16, the webs are separated at scrim sides with a dielectric buffer 38 (Figure 6) and all three pieces are brought together for subsequent heat-sealing operations, e.g. by dielectric heating in conventional fashion and not requiring detailed discussion herein. Those interested in such details, however, may refer to literature on the subject of which Electronics for Industry by W.I. Bendz is exemplary. John Wiley & Sons, Inc., is the Publisher.

If sealing with heated dies or the like is selected, buffer 38 would accordingly comprise a suitable heat insulating material.

A preferred next operation is to heat seal portions of top and bottom webs 14 and 16 along lines 40 each having the configuration of one of edges 28 and 30 of a respirator 10 to be produced. Figure 7 illus-

trates three such lines 40 from which three respirator bodies 12 will ultimately be completed. It should be understood, however, that similar heat-sealed lines 40*a* will be produced on web 16 which is not visible in Figure 7. In Figure 8, heat seals 40 and 40*a* are illustrated diagrammatically as single lines each.

Buffer 38 is next removed or the strip 42 of web materials is advanced therebeyond as at Figure 9 whereby heat sealing along lines 44, i.e. completely through both webs 14 and 16 completes the respirator outline in each case leaving heat seals 40 and 40*a* separable. Figure 10 illustrates the seal along lines 44.

Respirator bodies 12 are finally cut from supply strip 42 by trimming through webs 14 and 16 along, but outwardly of seals 40, 40*a* and 44. Headbands 32, 34 (Figures 1, 3 and 4) are then attached, e.g. with cement, rivits, staples or by heat sealing.

Ribs 24, 26 may be formed by heat sealing in a proper position on supply strip 42 at the time of forming seals 40, 40*a* (Figures 7 and 8), e.g. as shown with single lines 24*a*, or subsequent to cutting and removal of respirator bodies 12. In the latter case, a suitable buffer may be slipped into each respirator body 12 to prevent the ribbing from connecting the two webs 14 and 16 together.

Lastly, if not at an earlier stage of the process, chevron 36 (Figures 1, 3 and 4) in flat form is cemented in place.

Alternative fabricative procedures may include reversing the order of effecting seals 40, 40*a* and 44; precutting webs 14 and 16, i.e. before sealing the edges; using heated dies and pressure to form seals 40, 40*a* and 44 and/or sealing ultrasonically.

CLAIMS

1. A folded respirator comprising:

a pair of superimposed multiply layered webs of air-permeable materials, at least one of which is characterized by an adaptability to filtering undesirable airborne contaminants with a passage of air therethrough;

said webs each having one edge of special curvilinear outline for face-fitting purposes when said respirator is brought to use;

the materials of said webs being all edge joined together about all but said one curvilinear edge of each and similarly separately joined together along said curvilinear edges whereby selective separation of said separately joined curvilinear edges opens said respirator for wearing; and

means for holding said opened respirator against a wearer's face.

2. A respirator according to Claim 1 wherein said one layer of each of said webs comprises a lofty fibre media.

3. A respirator according to Claim 1 wherein said one layer of each of said webs is interposed between scrim and shell layers.

4. A respirator according to Claim 3 wherein each shell layer is disposed outwardly of said respirator for protection of said one air-filtering layer and each scrim layer is disposed inwardly of said respirator.

5. A respirator according to any of Claims 1 to 4 wherein said edges of said materials of said webs are heat sealed together.

6. A respirator according to Claim 5 wherein additional lines of heat sealing of said materials of said webs are included for reinforcement of said webs, said lines extending approximately perpendicularly to the general direction of each of said curvilinear edges of said webs.

7. A respirator according to any of Claims 1 to 6 wherein said respirator further comprises at least one headband having its opposite ends attached to at least one of said webs.

8. A respirator according to any of Claims 1 to 7 including malleable means affixed to a side of one of said webs for use in fitting said respirator to a face.

9. A respirator according to Claim 8 wherein said malleable means is in the configuration of a chevron.

10. A method of making a folded respirator comprising the steps of:

superimposing first and second webs of multilayered respirator facepiece material;

performing one of the following steps in an order preceding the other;

(a) separately joining layers of each web together along a line configured to provide a face-engaging edge of said respirator;

(b) joining all layers of said first and second webs together along at least one line extending away from an intended position of one of corresponding ends of said lines of face-engaging edges of said respirator to the opposite of corresponding ends of said face-engaging edges;

trimming said webs around and outwardly of all of said lines of joining of said materials; and

attaching head supporting means to at least one of said trimmed webs.

11. A method according to Claim 10 wherein said joining of said layers of materials is effected by heat sealing operation.

12. A method according to Claim 11 wherein said webs are trimmed to desired shape prior to said joining of said layers of materials.

13. A method according to Claim 11 wherein said separate joining of said web layers along lines configured for face engaging puproses is performed with a single heat sealing operation utilizing a heat sealing buffer between said webs to prevent joining of said face-engaging edges.

14. A method according to Claim 13 wherein said joining of all layers of said first and second webs is accomplished with a single heat sealing operation without employment of said buffer.

15. A method according to any of Calims 10 to 14 including the steps of attaching at least one headband to said trimmed webs.

16. A method according to any of Claims 10 to 15 further including attachment of a malleable chevron approximately centrally upon one side of one of said trimmed webs adjacent to said face engaging edge thereof.

17. A folded respirator substantially as herein described with reference to the accompanying drawings.

18. A method of making a folded respirator substantially as herein described.

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